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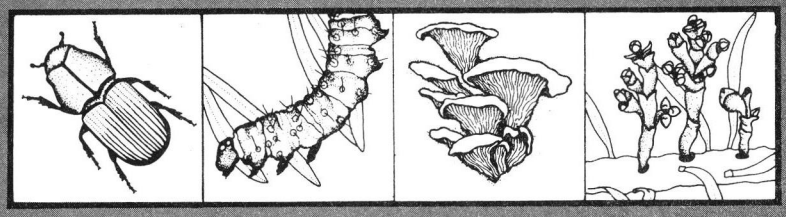

Report 84-5 April 1984

GUIDELINES FOR IMPLEMENTING DIRECT CONTROL TACTICS AGAINST THE DOUGLAS-FIR TUSSOCK MOTH

by

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When the EPA gave the Forest Service a one-time variance to aerially spray DDT for control of a 1974 Douglas-fir tussock moth outbreak, they also issued a charge to develop alternative management tools. Since then considerable progress has been made in efficacy testing, environmental impact assessment, and eventual registration of several chemical and microbial insecticides for tussock moth control.

The following is a status report of the insecticides tested and a listing of conditions that may favor the use of one material over another. These guidelines are intended as background information for pest management personnel to reference when reviewing tussock moth suppression alternatives with land managers.

Currently (2/84) the following chemical and biological insecticides are registered by the EPA for aerial spraying of Douglas-fir tussock moth infested forests:

Carbaryl (Sevin^{R})- 2 qts. Sevin-4 oil + 1-2 qts. oil for a total mix of up to 1 gal. per acre.

Acephate (Orthene^{R}) - 1 lb./gal. H_2O/acre

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B.t.[1] - 8 B.I.U.'s[2]/gal. H_2O/acre

NPV[3] - 1.1 Billion Activity Units/gal. H_2O/acre

Registration is being sought for:

Diflubenzuron (Dimilin) - 2 oz./gal. H_2O/acre

Supportive data exists that could lead to the eventual registration of:

Pheromone

B.t. - 12 B.I.U.'s/gal. H_2O/acre

Although carbaryl (2 lbs. ai.i./acre), acephate (1 lb./gal. H_2O/acre), NPV (1.1 billion activity units/acre), and B.t. (8 B.I.U.'s/acre) are currently registered for tussock moth control, only carbaryl, acephate and NPV are considered efficacious enough to be recommended for operational spraying.

Too few field experiments and pilot control projects have been conducted with B.t. to establish it as an effective treatment for Douglas-fir tussock moth at this time.

Because each tussock moth outbreak and each area is unique, it is not possible to review all conditions and situations that can exist. Certainly there is overlap in what materials are best suited for a given situation. Each outbreak must be evaluated on its own characteristics when selecting the most appropriate material and strategy. Such things as stage of the outbreak, extent and type of infested area, control objectives, environmental concerns, etc., must be considered in the development of a treatment approach. Table 1 describes several attributes of the possible control options.

Some treatment scenarios are presented assuming that registrations will be obtained for diflubenzuron (2 oz./acre); that a supply of NPV will be available; and that additional testing has been done with B.t. (e.g., increased dose-level), NPV (e.g., reduced dose-level and/or partial treatment of infestations), and pheromones (e.g., low population level tests).

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[1] B.t. = Bacillus thuringiensis Berliner.
[2] B.I.U.'s = Billion international units.
[3] NPV = Nucleopolyhedrosis virus.

Table 1.--Comparison of Douglas-fir tussock moth candidate insecticides.

	ENVIRONMENTAL CONSIDERATIONS									OTHER CONSIDERATIONS			
	Aquatics			Insects			Birds		Mammals				
Pesticide	Insects	Crustacea	Fish	DFTM[2]	Hymenoptera	Diptera	Cholinesterase inhibition	Diversity	Small mammals	Rain-fastness	Cost/acre[3]	Availability	Handling problems
Acephate	0[1]	0	+	90	-	0	—	0	+	Fair	$ 6.25	Good	None
B.t. (8 BIU)	+	+	+	70	+	+	+	+	+	Poor	$ 7.00	Good	None
Carbaryl	-	0	0	95+	-	0	-	0	+	Good	$ 8.00	Good	Residues in bottoms of barrels can be a problem.
Diflubenzuron	0	-	+	95+	+	0	+	+	+	Good	$ 9.00	Good	Requires special care to keep in suspension during mixing and use.
N.P.V.	+	+	+	95+	+	+	+	+	+	Poor	$15.00 - $25.00	Limited	May require special care to keep in suspension. Nozzle plugging has occurred with prior formulations.
Phermone	+	+	+	75 - 90+	+	+	+	+	+	?	$15.00	Good	Requires specialized application equipment.

[1] - = potentially severe damage; 0 = potentially very little damage; + = potentially no damage.

[2] Percent Douglas-fir tussock moth mortality expected.

[3] Cost of insecticide only as of June 1983.

Situations in Which Chemicals Could be Effective

1. Diflubenzuron: Diflubenzuron should be considered when treating infestations where:

   - very high population reductions are needed and light to moderate defoliation can be accepted,

   - where chemicals are preferred but extra concern exists for bees, aquatic insects, ants, and bird brain cholinesterase levels,

   - where impact to crustaceans is not critical,

   - where rainfastness is critical.

Diflubenzuron currently has label restrictions on its use over residential areas.

2. Acephate: Acephate should be considered when treating infestations where:

   - the most economical treatment is needed,

   - maximum foliage protection is needed,

   - chemicals are preferred but extra concern exists for aquatic insects,

   - rainfastness is not critical,

   - evaporation of a water-based spray is not expected to create problems.

3. Carbaryl: Carbaryl should be considered when treating infestations where:

   - very high population reductions are needed and light to moderate defoliation is acceptable,

   - rainfastness is critical.

Situations in Which Microbial Insecticides Could be Effective

1. NPV: NPV should be considered when treating infestations where:

   - very high population reductions are needed but moderate to substantial defoliation of the current year's growth can be tolerated,

- environmental safety is paramount,

- rainfastness is not critical.

2. NPV in Combination with Chemicals: NPV should be used in conjunction with chemicals to:

   - treat those portions of an outbreak where chemicals are not preferred, e.g., around residences, bee yards, near water sources, etc.

3. B.t.: B.t. should be considered when treating infestations where:

   - moderate to substantial defoliation can be tolerated the year of treatment,

   - environmental safety is paramount,

   - rainfastness is not critical.

4. B.t. in Combination with Chemicals: B.t. should be used in conjunction with chemicals to:

   - treat those portions of outbreaks where chemicals are not preferred, e.g., around residences, bee yards, water sources, etc.

Experimental Strategies

1. Partial Treatment of Infestations with NPV:

   a. One experimental strategy would be to treat "hot spots" and other high-risk stands (ridgetops, etc.) in conjunction with hazard rating stands. The intent would be to initiate an epizootic quite early in these areas reducing the Douglas-fir tussock moth population in the immediate vicinity and increasing the virus load in the general area.

   b. Another experimental approach to partially treat infestations with NPV is by treating alternate strips, every third strip, or other selected patterns. The intent would be to rely on atmospheric transport of the virus to uniformly contaminate the entire spray unit and initiate a general epizootic.

2. Pheromones for Control

   a. Areas of low, but increasing population levels: This strategy is aimed at holding back a population that is in the release phase. By so doing, it is expected that natural control agents will increase to levels sufficient to keep the population in check. Much effort would be required to define the project area.

b. Small localized, isolated infestations in sensitive areas: This strategy would be one of population reduction in outbreak areas where chemicals are not an option.

c. Follow-up treatments in areas where insecticides gave unsatisfactory results: This strategy would be one of getting a second chance during the same year at reducing the population when earlier insecticidal treatments gave unsatisfactory results. This "double treatment" approach would be very expensive.